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SCIENCE AND THE STATE OF MIND[1]

By Dr. WESLEY C. MITCHELL

PROFESSOR OF ECONOMICS AT COLUMBIA UNIVERSITY; PRESIDENT OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

YOUR president's invitation to address the American Science Teachers Association both flattered and intimidated me. An economist who has any inkling of what mathematics, astronomy, physics, chemistry and biology in its numerous branches have accomplished is grateful when representatives of these shining disciplines admit him to their company. But he feels that in their company his proper role is that of listener, not of speaker. Your techniques are far more advanced than his, your results are more securely established, you have and you merit higher prestige both in intellectual circles and with the general public. From you an economist should be able to learn much; whether he can make any return in kind is doubtful.

Yet there is a way of conceiving science that rationalizes, and perhaps justifies, both your invitation to speak and my acceptance. Despite the bewildering specialization of scientific inquiries, it is permissible to think of science as a unit. A physicist may not understand the technical papers of a physiologist, and *vice versa;* but the two workers approach their problems in the same spirit. Both workers seek to unite accurate observation of phenomena with systematic analysis of relations; neither expects that his results will be accepted unless they are confirmed by competent investigators who repeat his experiments and check his reasoning; each realizes that what he observes and what he thinks is influenced by a personal equation, but each tries to keep this factor from warping his conclusions more than is inevitable.

In short, we cherish the ideal that all scientific men are single-minded in their search for truth. We expect them to avoid wishful thinking; that is, they must not alter their findings to suit the non-scientific beliefs or longings or dislikes of others or themselves. All of them are supposedly ready to expose

[1] Address given at the luncheon of the American Science Teachers Association, Richmond, Virginia, December 29.

their results to criticisms by their fellows. We admit that it is difficult to live up to this ideal. Probably all of us are conscious of lapses in ourselves from strict scientific integrity, and suspect lapses in others. But we hold to our ideal as the state of mind that is characteristic of scientific work, whether that work is in mathematics or botany, geology or anthropology, chemistry or economics.

Men can treat any subject that excites their curiosity in this single-minded, critical, austere spirit. But some subjects are far easier than others to treat scientifically. These relatively easy subjects were the first ones to be brought within the realm of science, and they are the subjects in which science has made the greatest progress. Euclidean geometry and mechanics may serve as examples. The subjects that are harder to treat single-mindedly, critically and austerely were long dominated by non-scientific types of thinking—by worldly wisdom that scorned theory, by soaring speculation that was impatient of observation, by inner illumination that forbade skepticism. But the cumulative successes won by the scientific spirit in dealing with the easier subjects have embodied men in successive generations to extend the realm of scientific inquiry far beyond its early strongholds. While the older sciences were growing in reach and power, younger sciences were being born and passing through the diseases of infancy. It is as characteristic of the scientific spirit to beget new children as to lavish ever greater care upon the nurture of its elder offspring.

Economics is no longer the youngest child of science, but it is still an infant. Perhaps a century is an appropriate unit in which to reckon the age of a science. In that reckoning economics is barely two, whereas some of the sciences represented here claim to be more than two hundred—they have lost their birth certificates and don't know exactly how old they are. I hasten to add that in so long-lived a family two hundred represents, not decrepitude, but lusty youth.

Of course the very young sciences don't know how to behave as well as their elders. They have to crawl before they can walk, to walk before they can run. They make incoherent noises before they learn to talk intelligently: while they are learning to talk they use a limited vocabulary borrowed from others and not well adapted to their own needs. They are often obstreperous. Their more mature brothers and sisters feel at times like disowning them. But they are legitimate offspring of the same spirit that begot astronomy and mathematics, and if they are true to their begetter they will gradually acquire competence and grace. Yet the road before them is hard; for they are young precisely because the subjects with which they deal present graver difficulties than those with which the elder sciences deal.

We should not forget, however, that the more mature sciences had hard times in their younger ages. They encountered both inner and outer obstacles that they had to surmount by long-continued efforts. Let me recur to the examples of geometry and mechanics. We all know how the later Greek geometers got bemused by hazy speculations concerning the mystical significance of their constructions, and how Galileo's deductions got him persecuted by the church. I take the first to be an example of the inner, and the second to be an example of the outer, difficulties that science encounters in its search for truth—difficulties that assume ever-changing forms as this search is pressed into new territory.

It was pointed out long ago by a great psychologist that we can see the motes in our neighbors' eyes more easily than we can see the beams in our own eyes. Let us take easy things first, and consider some of the external difficulties that laymen put in the way of scientific work to-day.

I might take as an example of external obstacles to scientific work interference with the teaching of biology by those who think their religious beliefs are endangered by what they conceive to be the "doctrine of evolution." But that is too familiar and too obvious an issue to belabor. Nor need I dwell upon the efforts of the present masters of Germany to make science subservient to nationalistic ends. We all look forward to the day when German investigators can rejoin the international army of research workers, and assert again the right to freedom of inquiry and freedom of teaching their predecessors did so much to win for the world. It is better worth while to consider issues on which our minds are not so clear.

In all our schools children are taught American history. Now history may not claim to be a science, but a historian may have a scientific frame of mind. He may be single-minded in his effort to find out what "really happened"; he may be critical in his use of sources; he may strive to avoid wishful thinking. But if some of his conclusions run counter to the patriotic feelings of the parents of school children, he may find his intellectual virtues charged against him as faults. Some people who are ready to admit their own shortcomings feel shocked if their national heroes are represented as fallible. Many who are critical of current developments in our national life like to think of our national past as a record of stern virtues. If they admit that our country has at times gone wrong, they may still hold that patriotism should be inculcated in the rising generation, and that the safest road to that end is to soft-pedal unhappy errors and to stress what they approve. But a man who twists the truth, even for the best of ends, is doing violence to the scientific spirit. Teachers of science have so great a stake in

free inquiry that they should stand shoulder to shoulder with any of their colleagues who may be attacked because their findings are unpalatable to school authorities, to the general public or to special interests.

Similar issues sometimes become acute in teaching children about the way in which our governments, local, state and national, are organized and how they work. The instructor often finds it safer to confine himself to the pretty arrangements of municipal charters and county governments, the state and the federal constitutions. But teaching thus confined is poor preparation for performing the duties of a citizen. The future voter needs to know how aldermen and mayors, members of the legislature, county officials, congressmen and presidents are really chosen, the pressures under which they act and the arts by which political campaigns are conducted. Every alert adult knows that political practice often differs widely from political theory, but many prefer that children be brought up on what ought to be rather than upon what is. No scientifically minded man would advocate courses in muckraking; they would be as one-sided as political platitudes. There is always the possibility that some ardent reformer will try to make his classroom a center of propaganda, and claim to be suffering for righteousness' sake when he is discharged for incompetence or intellectual intemperance. The individual cases that crop up in this connection are often difficult to judge; for political science is one of the youngest children of the scientific spirit, and has as yet accumulated few assured findings. But those who have the will to stand for intellectual honesty can at least tell whether a man under attack has a scientific temper, the ability to observe objectively and to think dispassionately.

It may be agreeable to us as science teachers to dwell only upon obstacles that are put by others in the way of our work. But that would be treachery on our part to the scientific spirit. Our own professions require that we face also the inner obstacles that are raised by our own faults, intellectual and emotional. My impression is that these obstacles within us are more difficult to overcome than the obstacles without. Since the subject is a delicate one, I shall take my own discipline as the first and, you may think, the worst example.

Economics deals with the behavior of men in making a living. In modern times, most men get most of their livings by making and spending money incomes. This is an activity in which practically all adults have to engage, economists among the number. Both in making money and in spending money we have to defend our individual interests against people who would like to pay us less and charge us more than we like. There is a conflict of interests in almost every transaction in which we engage. As individuals we can often do little to defend ourselves against what we deem exploitation, or to exploit others—a term that we seldom apply to our own actions—others may save us the trouble. So we unite with people in positions like our own to form trade unions, trade associations, bondholders' committees, tax-payers' leagues, and the like, and we make the interests of these groups our own.

Thus economists can not be disinterested observers of economic behavior; they are participants in economic struggles. It is therefore far harder for an economist to be a single-minded, critical austere investigator than it is for a man who studies the behavior of gases or electrons or sea-urchins. Even if a man can set aside his individual interests, and there have been economists who have worked hard for policies that would cost them heavily, he can hardly divest himself of the preconceptions and emotional attitudes formed in him before he knew what economics is. Consciously or unconsciously, and the latter is the more insidious bias, he feels an urge for or against certain views. Much of orthodox economic theory is an open or a covert defence of private property and free enterprise in pursuit of profit. Perhaps there is as large a literature that attacks this form of organization under the guise of what purports to be scientific analysis.

Paraphrasing a passage in the presidential address that Edwin G. Conklin delivered before the American Association last year, let me say that science is concerned to show only what is true and what is false. By so doing it is of inestimable value in helping men to decide what is good for them and what is bad. But science itself does not pronounce practical or esthetic or moral judgments. The investigator who tries to persuade men that they should choose one course of action rather than another may be drawing sensible conclusions from his scientific findings, but he is certainly not doing scientific work when he does so. The investigator who consciously or unconsciously allows his preferences to shape or color his scientific findings is offending the scientific spirit. He may make contributions to our knowledge of what is true and what is false in the course of his analysis; but that will be a fortunate accident. Perhaps some attacks upon and defences of forms of economic organization are meritorious performances from other view-points; but they are not scientific, and whatever analysis of economic processes is incidental to them must be suspect. For the man who has a cause at heart, however fine that cause may be, is likely to prove a biased observer and a sophisticated reasoner. Economists find it peculiarly difficult to preserve a scientific frame of mind just because they deal with issues about which they and their fellows feel intensely.

Not to leave the impression that economists alone face inner obstacles when they try to do scientific work, let me recall a few derangements from which most of us suffer in some degree. We have our personal likes and dislikes that make it hard for us to assess impartially the scientific contributions of our fellow workers. Often these emotional aberrations take the still more irrational form of living or disliking large groups of people whom we don't know but about whom we imagine things. Who among us maintains a strictly scientific attitude toward what is called the race issue, either in the form that is acute in Germany or in the form that is acute in the United States? To be more offensively personal, is there any one so free from vanity that he can be strictly scientific about critical appraisals of his own work? And on a higher level, are not most of us conscious of an unreasoned predilection for certain types of scientific inquiry balanced by an equally unreasoned tendency to depreciate the value of other types?

I should hesitate to talk in this vein to any company not composed of scientific investigators. Just because other groups would probably have more biases per gram of gray matter than can be found in this room at present, it would be futile to dwell upon their intellectual limitations. Little but annoyance could result. But we who profess to follow the scientific ideal can face even our own deficiencies and lapses from grace in a scientific spirit. And the firmer our scientific temperaments, the readier we are to overcome so far as human nature allows the inner obstacles to scientific work.

We have, indeed, a high calling, and much depends upon how we acquit ourselves. Progress in human well-being is conditioned by progress in discovery in both the natural and the social sciences. Scientific discoveries are made by gifted individuals; but these individuals have to be conditioned for their work, and this conditioning is a social process. Even more patently, the application of scientific discoveries to human uses, good or bad, is work in which thousands share. Many citizens of the future have their most vivifying contacts with science through us. We do not expect to make many of them scientific lights, but we do expect to give most of them some impression not only of what science has accomplished but also of the spirit in which scientific men work, thus to influence their future attitudes toward science, and to promote the social processes that favor scientific discoveries and their applications. The most effective way to exercise this influence upon others is to cultivate the scientific spirit in ourselves.

SCIENTIFIC EVENTS

THE NEW GEOLOGICAL GLOBE AT THE SOUTH KENSINGTON GEOLOGICAL MUSEUM

It is reported in the London *Times* that a geological globe, 5 feet 11 inches in diameter and electrically rotated at the rate of one revolution in $2\frac{1}{2}$ minutes, was formally set in operation at the Geological Museum, South Kensington, on October 10, by Sir Frank Smith, secretary of the Department of Scientific and Industrial Research. This globe, which is believed to be the largest yet prepared to show both surface relief and the distribution of geological formations, was modelled by C. d'O. Pilkington Jackson and was colored by the museum staff, the painting being carried out by Mr. C. Keefe under the direction of Mr. A. J. Butler.

The scale adopted is approximately 1 in 7,000,000, or one inch to 112 miles. Mountain heights are exaggerated 20 times, and one of the most striking impressions which the new globe creates, according to the *Times,* is that of the comparative insignificance of even the loftiest mountains, for in spite of this exaggeration the summit of Everest projects scarcely more than an inch above sea-level. The globe rotates on its polar axis nearly 600 times as fast as does the earth, but the actual speed of a point on the surface of the earth is about 12,000 times that of the corresponding point on the model.

The various rocks of the earth's surface are shown by a graded series of colors, ranging from deep purple for the oldest rocks, formed perhaps 1,000,000,000 years ago, through shades of blue, green and yellow to a flesh-pink for the large areas covered by deposits laid down during and since the Ice Age. The igneous rocks are colored scarlet and orange. Ice-caps, rivers and lakes are also marked.

PERMANENT SCIENCE FUND OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES

Income from the Permanent Science Fund, according to agreement and declaration of trust, shall be applied by the American Academy of Arts and Sciences to such scientific research as shall be selected ". . . in such sciences as mathematics, physics, chemistry, astronomy, geology and geography, zoology, botany, anthropology, psychology, sociology and economy, history and philology, engineering, medicine and surgery, agriculture, manufacturing and commerce, education and any other science of any nature or description whether or not now known or now recognized as scientific; and may be applied to or through public or private associations,

societies or institutions, whether incorporated or not, or through one or more individuals."

Applications for grants under this indenture are considered by a committee of this academy on stated dates only. The next such meeting will be to consider applications received in proper order on blank forms furnished by the committee on March 1, 1939. Correspondence, including requests for application blanks, should be addressed to the chairman of the Committee on the Permanent Science Fund, Professor John W. M. Bunker, Massachusetts Institute of Technology, Cambridge, Mass.

Grants-in-aid from this fund were voted by the academy on October 19, 1938, as follows:

Professor D. C. Carpenter, New York State Experiment Station, Geneva, N. Y., $300, toward the purchase of optical equipment for an investigation of the effect of neutral salts on amino acids and proteins.

Dr. V. I. Cheadle, instructor in botany, Rhode Island State College, Kingston, R. I., $300, toward the cost of technical assistance in the preparation of material for the study of the conductive system in a group of the Monocotyledonae.

Dr. S. R. Gifford, Northwestern University Medical School, Chicago, Ill., $500, toward the cost of technical assistance in a study of the relation of the physical change of protein molecules in cataract of the eye.

Professor W. L. Gilliland, University of Maine, Orono, Maine, $250, toward the purchase of precision equipment for use in studying certain equilibria in Grignard reagents.

Professor F. L. Humoller, Loyola University School of Medicine, Chicago, Ill., $400, toward the cost of animals and materials in a study of the chemistry of a toxic fraction prepared from *Salmonella enteritidis*.

Dr. Valy Menkin, instructor in pathology, Harvard Medical School, Boston, $500, toward the cost of an investigation of the nitrogenous substances in areas of injury.

Professor Gregory Pincus, Clark University, Worcester, Mass., $800, for technical assistance and supplies in the further study of the development of artificially activated mammalian ova *in vivo* and *in vitro*.

Professor G. W. Prescott, Albion College, Albion, Mich., $175, toward the expenses of an investigation of phytoplankton in the Panama Canal Zone.

Professor Christianna Smith, Mount Holyoke College, South Hadley, Mass., $200, for the purchase of animals in a study of the origin and differentiation of red blood corpuscles.

Dr. Oswald Tippo, instructor in botany, University of Illinois, Urbana, Ill., $75, for the cost of text figures necessary for the effective publication of a monograph on the Moraceae.

Professor Dorothy W. Weeks, Wilson College, Chambersburg, Pa., $500, for technical assistance in extension of the analysis of the spectrum emitted by neutral iron atoms.

LEIGH HOADLEY,
Corresponding Secretary

AWARD OF THE HOOVER MEDAL OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

JOHN FRANK STEVENS, civil engineer of Baltimore, Md., who is now eighty-five years old, has been selected as the third recipient of the Hoover Medal, according to an announcement made by Dr. Gano Dunn, chairman of the Hoover Medal Board of Award. The medal will be presented to Mr. Stevens during the annual meeting of the American Society of Civil Engineers in New York City, which will be held from January 18 to 21, with the following citation:

> John Frank Stevens, engineer of great achievement as illustrated in his work on the Panama Canal, who, in his dealings with the Inter-Allied Forces in Siberia in the Great War, demonstrated those broader capacities for humanitarian public service beyond his calling which have earned for him the recognition of the Hoover Medal for 1938.

Mr. Stevens was born in West Gardiner, Me., on April 25, 1853. After serving as assistant engineer of the City of Minneapolis from 1874 to 1876, he became chief engineer of the Sabine Pass and North-Western Railway, followed by engineering service on practically every railroad in the Northwest, including the Chicago, Milwaukee and St. Paul, the Canadian Pacific and the Great Northern. Then in 1905 he was appointed chief engineer of the Panama Canal and later chairman of the Isthmian Canal Commission. From 1907 to 1909, he was vice-president in charge of operations of the N. Y., N. H. and H. R. R. Following this, he became president of several West Coast railroads.

In 1917, Mr. Stevens, then sixty-four years of age, went to Siberia as chairman of the Commission of Railway Experts to assist the Russian Provisional Government in the reorganization and operation of its badly organized railways. The Armistice and the Soviet ascendency stopped this work. However, Mr. Stevens remained in Manchuria and, with the collaboration of the American Ambassador to Japan, formed the Inter-Allied Technical Board, becoming president of it. Amidst revolution, disease and famine, Mr. Stevens and a band of devoted American railway men operated the crippled railways and kept open "the back door to Russia." As a result, the Allied troops in Siberia were withdrawn successfully, the railway operations maintained in the face of physical and personal difficulties, supplies and foodstuffs provided and the lives of thousands of natives saved.

In 1927, he was elected president of the American Society of Civil Engineers. Mr. Stevens has had awarded to him the John Fritz Medal for "great achievements," the U. S. Distinguished Service Medal and the Gold Medal of the Franklin Institute. He is

an officer of the French Legion of Honor and holds membership in the North Carolina Society of Engineers, the Pacific Society of Engineers, the Chinese-American Association of Engineers and the Engineers Club of Philadelphia.

The Hoover Medal was formally instituted on April 8, 1930, during the celebration of the fiftieth anniversary of the American Society of Mechanical Engineers, to commemorate the civic and humanitarian achievements of Herbert Hoover and to whom the first award was made. The second recipient was Ambrose Swasey in 1936. Conrad N. Lauer, fellow of the American Society of Mechanical Engineers and president of the Philadelphia Gas Works, created the award in 1929 with the gift of a trust fund which is held by the American Society of Mechanical Engineers and administered by the Hoover Medal Board of Award, consisting of representatives of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

OFFICERS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

A FULL account of the Richmond meeting of the American Association for the Advancement of Science and the scientific societies associated with it, edited by the permanent secretary, will be printed in the issue of SCIENCE for February 3.

Officers for 1939 were elected as follows:

President: Walter B. Cannon, Harvard University.

Vice-presidents of the Association and chairmen of the sections:

Mathematics (A): Marston Morse, Princeton University.
Physics (B): E. O. Lawrence, University of California.
Chemistry (C): Roger Adams, University of Illinois.
Astronomy (D): C. A. Chant, David Dunlap Observatory, Richmond Hill, Ontario, Canada.
Geology and Geography (E): Kirk Bryan, Harvard University.
Zoological Sciences (F): W. R. Coe, Yale University.
Botanical Sciences (G): Neil E. Stevens, University of Illinois.
Anthropology (H): Neil Judd, U. S. National Museum.
Psychology (I): ....
Social and Economic Sciences (K): Warren S. Thompson, Scripps Foundation, Miami University, Oxford, Ohio.
Historical and Philological Sciences (L): L. C. Karpinski, University of Michigan.
Engineering (M): ....
Medical Sciences (N): C. J. Wiggers, Western Reserve University.
Agriculture (D): Henry Schmitz, University of Minnesota.
Education (Q): M. R. Trabue, Pennsylvania State College.

Members of the Sectional Committees:

Mathematics (A): W. M. Whyburn, University of California at Los Angeles.
Physics (B): E. U. Condon, Westinghouse Research Laboratories, East Pittsburgh.
Chemistry (C): M. T. Bogert, Columbia University.
Astronomy (D): Robert H. Baker, University of Illinois.
Geology and Geography (E): William W. Rubey, U. S. Geological Survey.
Zoological Sciences (F): J. T. Patterson, University of Texas.
Botanical Sciences (G): E. N. Transeau, the Ohio State University.
Anthropology (H): Frank Speck, University of Pennsylvania.
Psychology (I): ....
Social and Economic Sciences (K): Carl Snyder, New York, N. Y.
Historical and Philological Sciences (L): Henry E. Sigerist, the Johns Hopkins University.
Engineering (M): ....
Medical Sciences (N): E. W. Goodpasture, Vanderbilt University.
Agriculture (O): H. C. Thompson, Cornell University.
Education (Q): Edward S. Evenden, Columbia University.

The Council: H. W. Odum, University of North Carolina; W. T. Vaughan, Richmond, Virginia.

The Executive Committee: J. McKeen Cattell, Garrison, N. Y.; Burton E. Livingston, the Johns Hopkins University, and Esmond R. Long, Henry Phipps Institute, Philadelphia (to fill the term vacant by the death of Earl B. McKinley).

Members of the Committee on Grants-in-aid: R. C. Fuson, University of Illinois; Vincent du Vigneaud, Cornell University Medical School.

Member of the Finance Committee: Charles S. Baker, Washington, D. C.

Nomination for Board of Trustees of Science Service: E. G. Conklin, Princeton University.

RECENT DEATHS AND MEMORIALS

DR. THOMAS WINGATE TODD, Henry Wilson Payne professor of anatomy at Western Reserve University and director of the Hamann Museum of Comparative Anthropology and Anatomy, died on December 28 in his fifty-fourth year.

DR. CALVIN BLACKMAN BRIDGES, known for his work in genetics at Columbia University and the California Institute of Technology under the Carnegie Institution, died on December 27 in his fiftieth year.

ARTHUR C. VEATCH, consulting geologist, pre-

viously geologist of the U. S. Geological Survey and head of the exploration department of the Sinclair Oil Company, died on December 24 at the age of sixty years.

DR. ROBERT RIDGWAY, consulting engineer, who retired as chief engineer of the Board of Transportation of New York City in 1932, died on December 19. He was seventy-six years old.

LLOYD LOGAN, professor of chemical engineering and head of the department at Syracuse University, died on December 29 at the age of forty-eight years.

DR. CHARLES J. STUCKY, who retired as head of the department of biochemistry in the School of Medicine of Georgetown University in 1936, died on December 26 at the age of forty-two years.

DR. SAHACHIRO HATA, assistant director of the Kitasato Institute for Infectious Diseases at Tokyo, Japan, died on November 22. He was co-discoverer of salvarsan with Paul Ehrlich.

IT is announced in *Nature* that the Cambridge University Press will publish shortly "Karl Pearson," a memoir consisting of two articles by his son. It surveys his life from his earliest days, giving extracts from letters to show the development of his philosophy and details of his many activities. It is illustrated with many portraits, and there are appendices summarizing his unpublished lectures and reports.

SCIENTIFIC NOTES AND NEWS

IN the New Year's honor list of King George of England the Order of Merit is conferred on Sir James Jeans, known for his work in mathematical physics and his books for the popularization of science. Sir James was professor of applied mathematics at Princeton University from 1905 to 1909. Five other scientific men are members of the order at the present time. These are Sir J. J. Thomson, Sir William Bragg, Sir Frederick Gowland Hopkins, Sir Charles Sherrington and Sir Arthur Eddington. Knighthood was conferred on Dr. Robert Robinson, professor of chemistry at the University of Oxford.

PROFESSOR HARLOW SHAPLEY, director of the Harvard College Observatory, has been elected a member in the section of astronomy, and Prince Louis-Victor de Broglie, of the Institut Poincaré, Paris, a member in the section of physics, of the Royal Swedish Academy of Sciences.

THE annual prize of $1,000 of the American Association for the Advancement of Science for a scientific paper presented at the meeting was awarded at Richmond to Dr. Norman R. F. Maier, of the University of Michigan, for his paper entitled "Experimentally Produced Neurotic Behavior in the Rat."

EDWARD A. WHITE, professor of floriculture and head of the department at Cornell University, has been awarded the gold medal of the Massachusetts Horticultural Society "for outstanding services in the field of horticultural education." Professor White organized the first department of floriculture in the United States at the Massachusetts Agricultural College in 1907.

ERNEST A. WILDMAN, professor of chemistry at Earlham College, Richmond, Ind., has received the faculty surprise award "as a great teacher of chemistry."

DR. WILLIAM H. PARK, until his retirement two years ago director of the Bureau of Laboratories of the Department of Health, New York City, observed his seventy-fifth birthday on December 30.

DR. T. WAYLAND VAUGHAN, emeritus professor of oceanography at the University of California and emeritus director of the Scripps Institution at La Jolla, was elected president of the Geological Society of America at the New York meeting. He succeeds Dr. Arthur L. Day, who retired recently as director of the Geophysical Laboratory of the Carnegie Institution.

DR. MAXWELL NAYLOR SHORT, professor of petrography at the University of Arizona, was elected president of the Mineralogical Society of America, succeeding Dr. J. Ellis Thomson, of the University of Toronto.

DR. RALPH W. CHANEY, professor of paleontology and head of the department at the University of California, was elected president of the American Paleontological Society, succeeding Dr. C. W. Gilmore, of the U. S. National Museum. Professor A. S. Romer, of Harvard University, was elected vice-president and Professor R. R. Shrock, of the Massachusetts Institute of Technology, treasurer.

AT the closing meeting in New York City on December 29 of the thirty-seventh session of the American Anthropological Association Dr. Diamond Jenness, curator of anthropology of the National Museum of Canada at Ottawa, was elected president to succeed Dr. Edward Sapir, Sterling professor of anthropology and linguistics at Yale University. Other officers elected were: *First vice-president,* Dr. John M. Cooper, of the Catholic University of America; *Second vice-president,* Dr. Earnest Albert Hooton, professor of physical anthropology at Harvard University; *Third vice-president,* Dr. W. Duncan Strong, associate professor of anthropology at Columbia University; *Fourth vice-president,* Dr. Ruth Benedict, head of the depart-

ment of anthropology at Columbia University; *Secretary,* F. M. Stezler, of the Smithsonian Institution; *Treasurer,* Bella Weitzner, of the American Museum of Natural History; *Editor of The American Anthropologist,* Dr. Ralph Linton, professor of anthropology at Columbia University. New members of the executive committee are Dr. Robert Redfield, dean of the division of social sciences of the University of Chicago; Dr. Elsie Clews Parsons, of Harrison, N. Y., and Dr. Robert W. Lowie, professor of anthropology at the University of Chicago.

DR. ENRICO FERMI, professor of physics at the University of Rome, will join the department of physics of Columbia University early in January. Professor Fermi was visiting professor at the summer session in 1936.

IT is announced in Washington that C. C. Conser has been made director of the western division of the Agricultural Adjustment Administration to succeed George E. Farrell.

DR. JOSEPH B. HOWLAND, since 1919 superintendent of the Peter Bent Brigham Hospital, retired on January 1 and has been succeeded by Dr. Norbert Anton Wilhelm, formerly assistant superintendent at the hospital, who has been since last April head of the Butterworth Hospital in Grand Rapids, Mich.

DR. JOHN R. MINER, associate statistician in the U. S. Public Health Service and formerly associate professor of biology in the School of Hygiene and Public Health of the Johns Hopkins University, has been appointed associate editor of the Mayo Clinic.

IT is reported in *Industrial and Engineering Chemistry* that Dr. W. Albert Noyes, Jr., head of the department of chemistry at the University of Rochester, who was elected editor-in-chief of *Chemical Reviews* at the Dallas meeting of the American Chemical Society, assumes direction of the journal this month. He succeeds to the position created by his father, Dr. Wm. A. Noyes, in 1924, becoming the third editor of the journal. Dr. Gerald Wendt, who has served as editor since 1927, submitted his resignation at Dallas to devote his entire time to his work as director of science at the New York World's Fair.

THE following changes have been made in the staff of the Field Museum of Natural History: William H. Corning, chief engineer since 1920, has been promoted to be superintendent of maintenance, filling the vacancy caused by the recent death of John E. Glynn; William E. Lake, formerly assistant engineer, becomes chief engineer; Arthur G. Rueckert, a staff taxidermist since 1923, has been appointed staff artist, and will have charge of the painting of backgrounds for habitat groups, replacing the late Charles A. Corwin. Other new appointments are Robert L. Yule, preparator in the department of anthropology, and W. E. Eigsti, a staff taxidermist.

DR. HERBERT E. BOLTON, chairman of the department of history at the University of California, who at the request of the university acted as an observer at the Pan-American Conference in Peru, is now visiting the universities of Chile, Argentina and Brazil in the interests of cultural relations between these universities and the University of California. Afterwards he expects to spend a short time visiting Caribbean lands, returning to the university in time for the opening of the spring term.

DR. DALLAS B. PHEMISTER, professor and chairman of the department of surgery at the University of Chicago, will give the sixth E. Starr Judd lecture at the University of Minnesota on February 1. He will speak on the "Pathogenesis of Gallstones." The late E. Starr Judd, an alumnus of the Medical School of the University of Minnesota, established this annual lectureship in surgery a few years before his death.

LECTURES of the Royal College of Physicians were given during November as follows: The Bradshaw Lecture on "The Chemotherapy of Bacterial Infections," by Dr. Lionel Whitby; the Fitzpatrick Lectures on "Conquest of Disease in the Tropics," by Dr. Harold Scott, and the Lloyd Roberts Lecture on "Some Problems of Human Congenital Disease," by Professor J. B. S. Haldane.

THE subject of this year's Christmas lectures for young people at the Royal Institution, London, was "Young Chemists and Great Discoveries." They were given by Dr. James Kendall, professor of chemistry in the University of Edinburgh.

A CONFERENCE of national park superintendents and other administrative field officers of the National Park Service will be held in Washington, D. C., from January 5 to 10 in the new building of the Department of the Interior. Present methods of operating, developing and administering the various federal park areas will be studied, with a view to effecting all possible improvements for the benefit of the traveling public.

THE Association of Official Agricultural Chemists at its meeting in Washington in November voted to establish three awards of $300, $200 and $100 to be known as the Wiley Memorial Awards to perpetuate the memory of Harvey W. Wiley, who for years served the association as secretary and later as honorary president. *Industrial and Engineering Chemistry* states that the faculty of any accredited college or university in North America is privileged to submit from among its senior student body one competitive thesis, compilation or résumé on any one of the sub-

ects dealt with in the several chapters of the association's book on "Methods and Analysis" and to nominate its candidate for the award to the committee of he Association of Official Agricultural Chemists, which vill make the final selection. All contributions must be n the hands of W. W. Skinner, secretary of the Association of Official Agricultural Chemists, Box 540, Benamin Franklin Station, Washington, D. C., on or beore August 1.

As announced at the time of his death in 1937, Henry Dazian, a leading theatrical costumer, left the bulk of is estate to establish a foundation for research in medicine and the creation of medical fellowships. According to a recent transfer tax appraisal the sum of 1,325,288 will go to establish the foundation. Under he will a self-perpetuating board of five physicians nd four laymen is designated to conduct the work f the foundation. Full power was left to the governing board to regulate the functions of the foundation and to direct distribution of its funds. Twentyve years after his death, Mr. Dazian directed that the principal of the trust funds be distributed to hospitals, anatoria and similar institutions selected by majority ote of the board. During the life of the trust, however, Mr. Dazian directed the board to create and maintain two fellowships, at not more than $2,500 yearly, for affording a post-graduate education to persons already holding a degree of doctor of medicine, so that they may specialize in some science directly or indirectly associated with medicine.

According to *Nature,* at a reception on December 6 t the Belgian embassy, Baron de Cartier de Marchienne, the ambassador, presented a number of bronze medals awarded by King Leopold of the Belgians to various British scientific workers. The medals, bearing on one side the head of King Leopold and on the other the name of the recipient, and the occasion of he award, were a token of appreciation for the help given by the various specialists in classifying the natural history collections which the King of the Belgians made in 1928–29 during his voyage to the East. The recipients, most of whom were present at the embassy, were: Sir Guy Marshall, Dr. K. Jordan, Dr. Isabella Gordon, Dr. S. Maulik, Dr. W. H. Leigh-Sharpe, Miss G. Ricardo, C. L. Collenette, Mrs. L. M. I. Macfadyn, W. H. T. Tams, H. E. Andrewes, Miss I. Meyrick (for her late father, Mr. E. Meyrick), Professor H. Gordon Jackson, Dr. H. Hanitsch, C. J. Arrow, Dr. Evelyn Cheesman, Dr. Marie V. Lebour, Dr. Schwarz, L. B. Prout, A. J. T. Janse and Lieutenant-Colonel F. C. Fraser.

The British Commonwealth Scientific Conference which met in London in 1936 recommended that an Imperial Bureau of Dairy Science should be established with headquarters at the National Institute for Research in Dairying, Shinfield. According to *The Lancet,* this recommendation has now been carried out and Professor H. D. Kay, D.Sc., director of the institute, has also been appointed director of the new bureau, while W. G. Sutton, from Massey Agricultural College, New Zealand, has been appointed deputy director. The bureau is financed cooperatively by the governments of the British Empire in the same way as the other imperial agricultural bureaus. The bureau will index research work in dairy science, and collect, abstract and collate information which it will distribute both by publication and by private communication to research workers, officials and advisory officers throughout the empire. Its ambit will include the microbiology, chemistry and physics of milk and its products; animal diseases in so far as they affect milk and its products; the technology of processing milk and manufacturing dairy products; the physiology of milk secretion as affecting quality and quantity of milk and dairy products; and standards for the composition and quality of milk and its products. The bureau will also promote conferences of workers and visits to research centers, and encourage the circulation of information, ideas, material and personnel.

It is reported in the *Journal* of the American Medical Association that the building of the Japanese institute for research in military aviation medicine, under construction since last summer on the top of Mount Fuji (3,778 meters), was completed in July. The opening ceremony was held in August, with many prominent military surgeons present. The costly building contains fourteen rooms with complete protection against cold, and it is situated next door to the station belonging to the Central Meteorologic Observatory. There will be a standing staff consisting of two army surgeons, and two men from the military medical school will alternate yearly as assistants. The chief research will be on such subjects as the physiologic state of the human body at a high altitude and the hygiene of aerial navigation. This is the first institution of this kind in Japan.

DISCUSSION

AN OUTWORN NOMENCLATURAL PRACTICE

The old dictum that "nomenclature is a means not n end" probably needs even more emphasis now than formerly. Always a practical matter, nomenclature in a practical age and one with vastly increased demands has little place for tradition unsupported by modern needs.

An ideal system of nomenclature and many of the details of its practice should meet the needs not only of working taxonomists and specialists, but, so far as possible, also of general zoologists, paleontologists, anthropologists and laymen. Doubtless the specialist should not unduly sacrifice his requirements for those of the layman, but any simplification which he can make tending toward the ideal is likely to be a forward step. It is idle to say that the layman should be disregarded entirely, for he is not sharply distinguishable and, as knowledge becomes more and more synthesized, he demands increasingly the privilege of using it, not only as to its generalizations but even as to its technique.

Established nomenclatural practices are not lightly to be changed. Most of them are the result of hard experience and, especially those written into official codes, are born of necessity and struggle. There appear to be some, however, that go back to a time when names were relatively few, that have never been the subject of controversy and that now persist after they have become burdens rather than advantages. One of these, to which attention may be called, is the practice of enclosing in parenthesis the authority for specific or subspecific names which have been transferred from one genus to another. To discontinue this would be a blessing to the active taxonomist, to whom it is now needless, and also to the layman, to whom the name itself is a sufficient irritation without this added esoteric source of mystification.

Apparently the first sanction for the use of the parenthesis is that found in the so-called Stricklandian code authorized by Section D of the British Association and published in 1842, nearly a century ago. Here there is lengthy discussion of the relative merits of first and second authorities with decision in favor of the first and recommendation that the authority for the specific name when not also that for the combination should be enclosed in parenthesis and followed by the symbol (sp.). The example given is "*Tyrannus crinitus* (Linn.) (sp.)," thus written. This obviously awkward arrangement is then followed by a footnote stating that "The expression *Tyrannus crinitus* (Linn.) would perhaps be preferable from its greater brevity." Double authorities seem not to have been considered at this early date and zoologists do not now use them. If any zoologists ever used them, the practice was soon discontinued. For botanists, who "worship the combination," as some one has said, the parentheses may be defensible; but zoologists, having dropped the second authority, should also drop the parentheses.

It is difficult to see much advantage in the parenthesis even as it was used by early authors when it was less called upon to indicate a changed combination than now. It merely drew attention to the fact of a change for any cause whatever and could not go farther as to the time, place or reason for such change. These details were to be found in the synonomy, and even then they were not always fully evident, so it was only the specialist in the group concerned who understood all the implications of the symbol. For him, therefore, it was likely to be superfluous, and for any one else its significance was almost or quite negligible. A name with its authority in parenthesis simply had a different history from that of one without it. It was not necessarily one that had a longer or more vicissitudinous history, since it was quite possible for a name to be changed and carry the parenthesis for a considerable period and then return to its original form, when the parenthesis would be omitted.

In the nineteenth century, when generic concepts were relatively static, the transfer of a species from one genus to another was an event which assumed an importance that can scarcely be claimed for it now. To signalize such a change may have had some advantages when the field was limited and before the tremendous expansion of knowledge and refinement of practice which has taken place in recent years. As every one knows, the species of Linnaeus is the genus of to-day with the result that the great majority of early nomenclatural combinations have been changed and there is no great need to point out each one individually.

The International Code of Zoological Nomenclature directs the use of the parenthesis only in cases involving changed generic and specific combinations. In spite of this, several rather prolific writers have assumed to use the parenthesis to indicate any change whatever from the form originally written, even though the generic term remains the same. Especially they have used it for names changed from binomials to trinomials, or *vice versa,* and, since such names often act as if on a pendulum, there is little accomplished except mental exercise. This, it seems to me, is compounding a felony. Probably some of them would not draw the line even at changes in spelling or capitalization.

Possibly there are some advantages in retaining the parentheses, but even so, they are greatly outweighed by the practical inconveniences. For a number of years my personal experience has engendered a growing antipathy to them. As a writer on taxonomic subjects, as an editor of taxonomic manuscripts, as a provider of popular printed matter and labels for a large museum and a zoological garden and as an adviser to amateur naturalists, I have found the parenthesis a constant source of irritation and loss of time. For some years I have ceased to use it on museum labels and am now spared the attempt to explain it to print-

ers, proofreaders and public. Also in recent technical papers of my own it has been omitted. One of these[1] dealt with some 250 species and had a fairly wide distribution. After six years, no one has complained. Moreover, I have discussed the matter with various zoologists and do not find them inclined to offer defense unless on grounds of pure conservatism.

Typographically the parentheses are not desirable. They often mar the appearance of the printed page, and they are always anathema to the proofreader. Some amusing incidents have occurred. In one case, a very competent proofreader, finding some names with and some without parentheses, very carefully supplied the omissions and the change was not detected until final proofs were reviewed. In a very recent publication[2] the proofreader or editor completely triumphed. Here every one of nearly 150 authorities is carefully placed not in parentheses but in brackets, obviously without the knowledge or consent of the author.

Since the foregoing was written, I have read two recent communications to SCIENCE[3] discussing related subjects. Like Dr. Jacot, I agree with Mr. Peattie that single authorities are sufficient, and the fact that zoologists find them so seems pretty good evidence. However, it may be readily conceded that botanists at this time, having a different historical background, may wish to retain the double authorities for good reasons which do not apply in zoology. To change the single authority to the maker of the combination as advocated by Mr. Peattie would be highly impractical for zoologists at this late date. Some of the arguments he makes for it were discussed in the Stricklandian code of 1842, previously mentioned. Since then all the emphasis has been upon the original describer of the species, who has been thoroughly indexed and docketed, while the maker of the combination has been given scant recognition. In connection with Mr. Peattie's zoological example, it is fair to assume that the same authority which informed him that *Butorides virescens* is the current name for the green heron would also give him chapter and verse relative to the original Linnaean name *Ardea virescens*. This authority naturally would be the Checklist of the American Ornithologists' Union. In other words, it would be practically impossible for him to obtain the combination from a really authoritative source without also finding the original reference.

It may be that both botanical and zoological practices are due for great changes in the future; but unless zoologists are willing to make a beginning by such a change as dropping the superfluous parenthesis, it will be more than the hundred years suggested by Dr. Jacot before much progress is made.

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[1] *Field Mus. Zool. Ser.*, 18: 193–339, August, 1932.

[2] Dixon, "Birds and Mammals of Mount McKinley National Park," U. S. Department of the Interior, National Park Service, Fauna Series, No. 3, 1938.

[3] Peattie, SCIENCE, 88: 128, August 5, 1938; and Jacot, 88: 240, September 9, 1938.

ESKIMO SEXUAL FUNCTIONS

WHITAKER, in his recent note on Eskimo sexual functions,[1] quotes some interesting data from Bertelsen[2] regarding the age at menarche among these people, and raises again the much discussed question as to the reliability of Dr. Cook's reported observations a half century ago.[3] Bertelsen now finds the age at menarche to be 15½ years, while a half century ago Dr. Cook stated that it occurred at the age of 19 or 20 years. And a century ago MacDairmid[4] said that the menses did not begin until about the age of 23 years. Because of the wide variance in these reports, must we discard the earlier ones as unreliable, and accept only the recent one based on carefully collected statistics? May there not have occurred among the Eskimos the same marked progression of the menarche toward earlier ages that has been witnessed in many other regions of the earth during the last century?

Original masses of statistics recently calculated by the author[5] gave mean ages at onset of the menses as follows:

Germany,	Göttingen,	1795	16.6 years
	Munich,	1864	16.3 "
	Munich,	1880	15.4 "
	Giesen,	1920	14.5 "
Norway,		1868	16.1 years
		1935	14.5 "

U. S. A., Cincinnati

Age of Women (1935) (Years)		Mean Menarchial Age (Years)
24	under 20	13.13 ± 0.22
78	20–29	13.77 ± 0.11
125	30–39	14.09 ± 0.10
118	40–49	14.29 ± 0.11
97	50–59	14.75 ± 0.14
62	60–69	14.76 ± 0.14
48	70–79	14.67 ± 0.17
22	80–89	14.77 ± 0.34
1	91	in her 15th year.
Philippine Islands, Cebu (1935)		
64	under 20	14.48 ± 0.11
65	20–29	$15.59 + 0.14$
76	30 +	15.71 ± 0.11

Similar findings have been obtained from many countries and from different races, always showing a progressively earlier onset of the menses. Girls entering the Universities of Cincinnati, Southern California and Wisconsin have exhibited a reduction of menarchial age from over 14 years for those born before 1900,

[1] Wayne L. Whitaker, SCIENCE, 88: 214, 1938.

[2] A. Bertelsen, *Meddelelser om Grønland*, Bd. 117: nr. 1, 1935.

[3] F. A. Cook, *Trans. N. Y. Obstet. Soc.*, 1893–4.

[4] E. M. Weyer, "The Eskimos," p. 48, 1932.

[5] C. A. Mills, *Human Biology*, 9: 43, 1937.

down almost to an even 13 years for those born in 1918. This march toward ever earlier menarchial age seems to be a world-wide phenomenon no longer subject to question.

The earlier development of menstrual functions has been accompanied by a steady and marked improvement in growth and adult stature, an improvement found in practically every population mass for which growth statistics have been examined in recent years. In animals, also, it has been pretty well established that the time of onset of sexual functions is determined more by the stage of physical development than by chronologic age. More rapid growth in animals, as in girls, is associated with earlier onset of sexual functions.[5, 6, 7, 8] The change in menarchial age so universally observed in many countries and races may therefore well be regarded as only one phase of the general world-wide quickening and improvement in the physical development of man.

In the light of this more general view of the facts available, would it not perhaps be better to place more reliance on the observations of MacDairmid and Cook, even though they are unsupported by actual statistics? It may be that the menarchial age for these Eskimos did change from nineteen down to fifteen and a half years during the last half century. Such would be an 18 per cent. reduction, as against the 11 per cent. witnessed in Germany up to 1920.

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ERYTHROCYTES OF SLOTH

IN a recent article appearing in SCIENCE,[1] entitled "Elliptical Erythrocytes," Dr. M. C. Terry has expressed hope "that some one who is in a position to do so will tell us who is right about the erythrocytes of the sloth." The point in question concerns the actual shape of the erythrocytes.

During the past year while a research fellow in the laboratory of histology under Dr. H. E. Jordan, we had an opportunity to study the blood elements of the two-toed Panamanian sloth (*Choloepus hoffmanni*). A number of these animals had been secured and transported to Virginia for study by Dr. S. W. Britton, who in turn furnished us with material for future investigations.

Study of freshly drawn blood, blood smears and bone marrow smears has reassured us that Jordan was correct in his statement that "among mammals the shape of the red blood corpuscles is uniformly that of a circular biconcave disk, except in the Camelidae, where these elements have an elliptical shape." In smear preparations of blood, as well as in stained sections of various tissues of the sloth, erythrocytes are frequently distorted, while many of the less distorted ones present an elliptical shape. In blood smears of both the cat and rat, similarly distorted erythrocytes having an elliptical shape are frequently observed. Any deviation from the circular shape of red blood corpuscles among these animals, as observed in prepared material, is unquestionably due to external factors.

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SCIENCE IN THE OLD SOUTH

IN an article entitled "Science and Society in Ancient Rome," Dr. William Salant[1] in advancing the view that society determines the growth or the decline of science, states: "As Kofoid[2] pointed out in a recent article, science worthy of the name scarcely existed in the South before slavery was abolished."

Dr. Kofoid's article is a review of a book entitled "Scientific Interests in the Old South," by Dr. Thomas Cary Johnson, Jr., associate professor of history in the University of Virginia. Dr. Kofoid states: "The author's theme is the *refutation of the summary indictment* of Morrison in 'The Oxford History of the United States,' volume 2, page 15, of the 'non-existent intellectual life' of the South, due to the cultivation of cotton, the neglect of men and the blight of slavery. *The data assembled support his defence*, for they display a wide-spread and active interest in the physical, chemical and medical fields, and a considerable though desultory activity in the natural sciences." (Italics mine).

Among the little-known facts brought out by Professor Johnson are the following: William Barton Rogers, founder and first president of the Massachusetts Institute of Technology, which opened its doors to students (including women) in 1865, succeeded his father, P. K. Rogers, in 1829 as professor of natural philosophy and chemistry at William and Mary College, and from 1835 to 1853 served as professor of natural philosophy and geology at the University of Virginia. On December 11, 1787, James Rumsey of Virginia ran a steamboat of his own invention against the current of the Potomac River at a speed of four miles per hour. Cyrus McCormick, of Pocahontas County (then in Virginia), invented, made and sold his reaper on his father's farm there from 1839 to 1844. Immediately following the opening of the Baltimore and Ohio's first division in 1830, came the Charleston-Hamburg (S. C.) line, with the *Best Friend of Charleston*, the first locomotive made in America for

[6] Carl G. Hartman, SCIENCE, 74: 226, 1931.

[7] Frank K. Shuttleworth, Monographs of the Society for Research in Child Development, National Research Council, Vol. II, No. 5 (Serial No. 12), Washington, 1937.

[8] Cordelia Ogle, *Amer. Jour. Physiol.*, 107: 628, 1934.

[1] SCIENCE, 88: 475, November 18, 1938.

[1] *The Scientific Monthly*, December, 1938.

[2] SCIENCE, 88: 109, 1938.

regular and practical use. "Maury of Virginia, pondering the results of deep-sea soundings, discovered the Atlantic plateau and suggested the Atlantic cable to Cyrus Field." Among the many other Southern scientists mentioned by Professor Johnson are J. Lawrence Smith, John James Audubon, H. W. Ravenel, John W. Mallet, F. P. Venable, Lewis R. Gibbes, Wm. C. Wells, John and Joseph Le Conte. The National Museum Report (Washington, 1897) links Thomas Jefferson with Agassiz as having done so much for science in America, mainly by the immense weight given science by their advocacy.

It seems to me that any unprejudiced person, looking through this book and considering the facts about the South, will agree that Dr. Salant's sweeping statement is unwarranted. Perhaps he was misled by what Dr. Kofoid said in commenting on the *arrangement* of the subject-matter of the book: "Details of evidence of educational interest abound, but a synthesis of accomplishment in the several disciplines is not achieved. There is a noticeable absence of evidence of sustained activity by productive investigators in scientific fields."

For a number of years past I have been trying to accumulate data as to what scientists of the South did to aid the Confederacy in the face of a stringent blockade. The sunken Merrimack was raised and converted into an ironclad, the Virginia. The Charleston submarine, Little David, repeatedly went down with all hands, only to be raised again to damage a Federal ship before her last plunge. The gunpowder made by Colonel Rains was so excellent that what was left after the war was used in the gunnery school at Fortress Monroe and was declared by a British officer to be equal to the best British powder. I will welcome any data showing what scientists did for the Confederacy.

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SCIENTIFIC BOOKS

CRYPTOGAMIC BOTANY

Cryptogamic Botany. BY GILBERT M. SMITH. Vol. I, $4.00; Vol. II, $3.00. McGraw-Hill, 1938.

ANY thorough-going review of G. M. Smith's "Cryptogamic Botany" would require that each of the several sections of the two volumes be separately considered by a specialist in the field concerned. With the first volume dealing with algae and fungi and the second with bryophytes and pteridophytes, the author has covered so wide a field that a critical appraisal of all the diverse parts would demand the services of a phycologist, a mycologist, *et al.* It is certain, however, that this work is of major importance in the general field of plant morphology and phylogeny, both because it does cover so extensive a field, because of the scholarly quality and workmanship, and because it represents an attack on general problems in plant science which have received far too little attention. Without attempting to be thorough in any particular field, the present reviewer would like to call attention to certain aspects and implications from the standpoint of a biology teacher.

What is meant by the standpoint of a biology teacher may perhaps deserve some definition. While it is still broadly true, as noted by Thaxter some years back, that most "biologists" are zoologists who teach something about plants in courses and text-books designated as "biological," there are a number of "biologists," like this reviewer, whose antecedents are botanical, and some biology texts which have joint zoological and botanical authorship. Without any definite figures as support, the opinion is ventured that the vast majority of students make their first acquaintance with organized plant and animal science in biology courses and biology texts. Long experience in such courses, with a total approaching fifteen thousand students, makes this reviewer certain that there is such a thing as a "biological" point of view, even if no more is granted to biology courses than the success of a foundling cowbird, that of survival and multiplication.

The term "biology," first used by Lamarck and Treviranus in 1800, was coined to give expression to the idea of the essential unity of plant and animal phenomena, of which these men, whose work was biological in the truest sense, had gained some preliminary appreciation. Verified in the succeeding century, through the cell and protoplasm doctrines, through evolution and genetics, and through the physico-chemical analysis of living things, the implications of the broadest biological point of view are still often misunderstood. Too often, a biology course may mean an introduction to plant structure in terms of possible "dorsi-ventrality," or to plant functioning in terms of an assumed "physiological gradient"—in other words, on the kind of analogical reasoning basis by which Aristotle and Cesalpino interpreted plant structures and activity from their acquaintance with animals. The converse is sometimes true, when terms, exactly applicable only in a restricted botanical sense, like tropism, are applied in the zoological field to a wide diversity of different phenomena, as H. S. Jennings has pointed out.

In a general biological sense, the Smith text is important because it represents one of few attempts

on the part of botanists to place plant classification on a broad phylogenetic basis. When a biology teacher attempts to place before his students, on a comparable basis, pictures of the plant and animal kingdoms and their subdivisions, he finds that zoologists have proceeded much further in dividing the animal kingdom into well-demarked, commonly accepted groups than have the botanists. First of all, he runs across the difference in terminology; the plant kingdom is divided into "divisions"; the animal kingdom into "phyla." "Division" is, of course, orthodox botanical usage, written down in the code of the Fifth International Botanical Congress of 1930, and followed practically exclusively in botanical writings, except by those rare plant biologists, like C. E. Bessey and J. H. Schaffner, who have been interested in delimiting the "phyla" of the plant kingdom.

While, scientifically, this difference in terminology may be considered trivial, the question is raised here whether there may not also be an unsuspected biological significance as well. Is it not a fact that the word "phylum" is much more appropriately applied to the subdivisions of the animal kingdom? That zoologists have really succeeded in recognizing and defining genetically determined phyletic groups, while botanists have been satisfied to go along with such catch-all congeries as "Thallophytes," a group which may be compared in content to the whole animal subkingdom of invertebrates?

That botanists have been slower in analyzing the plant kingdom into natural, more or less coordinate "phyla" has several possible explanations. The problem is vastly more difficult, the basis of subdivision less obvious, requiring biochemical discriminations of pigments, reserve food storage, etc., instead of the more obvious structural features by which animal phyla are separable. Moreover, it seems certain that in plants unicellular types will be found in several well-differentiated phyletic groups, while all one-celled animals are comprised in a single phylum. In the most critically difficult fields, of phycology and mycology, a great amount of pioneer work is still needed; botanists are still concerned with intensive studies, and, so far as fungi are concerned, the emphasis is chiefly economic. Even with the vascular plants, it is only within the past forty years that the anatomical and paleontological groundwork upon which a phyletic grouping may rest, has been accomplished.

"Acceptance of the view that various series of algae are more or less independent of each other means that both the Thallophyta and its subdivision Algae must be abandoned as natural units in classifying plants." From this premise, Professor Smith proceeds to carve nine phyletic groups out of the heterogeneous Thallophyta: Chlorophyta, grass-green algae; Euglenophyta, euglenoids; Pyrrophyta, cryptomonads and dinoflagellates; Chrysophta, the yellow-green algae (diatoms, etc.); Phaeophyta, or brown algae; Cyanophyta, blue-green algae; Rhodophyta, red algae; Myxothallophyta, slime molds; and Eumycetes, or fungi. The subdivision of the true algal groups follows lines which have been more or less anticipated by other writers, like Tilden, and is based upon the biochemical studies of men like Willstätter, etc. It is surprising to find no acceptance of the widely held opinion that the fungi themselves are polyphyletic, and that some fungi have real genetic relationships with certain algal groups. Bacteria are not included in the classification.

With his opinion that the higher vascular plants have been derived from Bryophyta, Dr. Smith recognizes that a majority of botanists will disagree. On the other hand, it is suggested here that while the great majority of general texts in botany are in agreement with Smith in keeping Pteridophyta and Spermatophyta as distinct phyla, the weight of evidence from plant anatomy and morphology and from paleobotany of the last forty years is preponderant for the conclusion expressed by Eames recently ("Vascular Plants. 1936"): "Seed habit can not be used to separate the vascular cryptogams from the phanerogams because of seeds found on the ancient group of fern-like plants." In other words, while the thallophyte miscellany has been long in need of subdivision, two other plant "divisions," Pteriodophyta and Spermatophyta, may just as reasonably be joined to form the Tracheophyta.

Finally, the importance of working toward a natural system of subdividing the plant kingdom is urged upon the authors of botanical texts and also on "botanical biologists." Such a division of Thallophyta as is presented by Smith is a distinct step in advance of present practice. It is not really more difficult to treat of nine phyletic divisions of the plant kingdom than to keep Thallophyta and then discuss its nine subdivisions.

R. C. BENEDICT

BROOKLYN COLLEGE AND
BROOKLYN BOTANIC GARDEN

SOCIETIES AND MEETINGS

THE TENNESSEE ACADEMY OF SCIENCE

THE forty-second meeting of the Tennessee Academy of Science was held at Vanderbilt University on November 25 and 26, 1938. The first general session was on Friday morning from 9 o'clock to noon, President Jesse M. Shaver presiding. Friday afternoon sec-

tional meetings were held, with Dr. Philip Rudnick chairman for physics, Dr. L. C. Glenn for geology and Dr. H. M. Jennison for botany. At the academy dinner on Friday evening Dr. George R. Mayfield, of Vanderbilt University, was toastmaster, President Shaver made an address on the subject, "How to make a Great Man," and Professor D. M. Brown, of the State Teachers College, Johnson City, presented a moving picture of "Rhododendron Gardens of Roan Mountain." On Saturday morning the second general session was held, Vice-President Aaron W. Dicus presiding, and the reading of papers was resumed. Classification of the papers on the program shows fourteen from two universities, ten from three colleges for teachers, eight from other schools, nine from federal and state organizations, and three from other sources.

On adjournment at 12 o'clock, Saturday, President Shaver called the members to order for the annual business meeting. The report of the secretary showed the membership practically the same as one year ago—430, including 69 fellows and 34 annual members of the American Association for the Advancement of Science. The appointment of a boy and girl from science clubs in the state for annual honorary junior membership in the association was placed in the hands of the executive committee. A resolution was adopted thanking Governor Gordon Browning for his efforts in the line of state conservation during the past two years and requesting Governor-elect Prentice Cooper to continue the work under his administration. Nineteen applicants were elected to membership in the academy. Officers elected for the year 1938–39 were:

President, Aaron W. Dicus, Tennessee Polytechnic Institute, Cookeville.

Vice-President, William M. Mebane, State Teachers College, Murfreesboro.

Secretary-Treasurer, John T. McGill, Vanderbilt University.

Officers of the Sections: Botany—*Chairman,* George R. Gage, Vanderbilt University, and *Secretary,* Chester P. Freeman, State Teachers College, Memphis; Geology—*Chairman,* George M. Hall, University of Tennessee, Knoxville, and *Secretary,* Kendall E. Born, Department of Geology, Nashville; Physics—*Co-chairmen,* Kenneth E. Hertel, University of Tennessee, Knoxville, and Newton Underwood, Vanderbilt University.

The 1939 spring meeting of the academy will probably be at some point in West Tennessee, the locality and date to be fixed by the executive committee.

JOHN T. MCGILL,
Secretary

THE INDIANA ACADEMY OF SCIENCE

THE fifty-fourth annual meeting of the Indiana Academy of Science was held at West Lafayette, Indiana, on November 3, 4 and 5, 1938, with Purdue University as host, and President Eli Lilly, of Indianapolis, in active charge. The first general session was largely devoted to honoring Dr. Joseph Charles Arthur and Dr. Stanley Coulter, both emeritus professors of Purdue University and former presidents of the academy. Dr. Frank D. Kern, dean of the Graduate School, Pennsylvania State College, paid tribute to Dr. Arthur in an address, "The Life and Work of Joseph Charles Arthur," and Dr. Ray C. Friesner, Butler University, honored Dr. Coulter with "A Tribute to Dean Stanley Coulter."

A total of 29 papers was presented at the general meetings and the nine divisional meetings. The attendance at these meetings was 450. Special action was taken by the academy to put into operation at the next annual meeting the plan for giving honorable mention to the authors of outstanding papers presented at the meeting.

The annual dinner meeting was attended by 250, following which President Lilly gave his president's address on "A Plan for Accomplishing More Effective Research." The officers chosen for 1939 are: T. G. Yuncker, DePauw University, *President*; Louis A. Test, Purdue University, *Vice-President*; William P. Allyn, Indiana State Teachers College, *Secretary*; William P. Morgan, Indiana Central College, *Treasurer*; Paul Weatherwax, Indiana University, *Editor of the Proceedings*; Will E. Edington, DePauw University, *Press Secretary*. The divisional chairmen for 1939 are: Paul Weer, Indianapolis, Archeology; W. A. Jamieson, Indianapolis, Bacteriology; Winona Welch, DePauw University, Botany; Herman T. Briscoe, Indiana University, Chemistry; Thomas M. Bushnell, Purdue University, Geology and Geography; P. D. Edwards, Ball State Teachers College, Mathematics; R. B. Abbott, Purdue University, Physics; F. B. Knight, Purdue University, Psychology; C. P. Hickman, DePauw University, Zoology.

The entomologists and taxonomists of the state held their meetings on Saturday, the latter group conducting a symposium on "The Concept of the Species."

The Junior Academy of Science also held its meetings on Saturday with an attendance of 250, representing forty high-school science clubs. A number of exhibits and demonstrations of the work of the high-school science clubs of the state was shown and also nine papers were read. Dean Howard E. Enders, Purdue University, is academy sponsor for the Junior Academy.

WILL E. EDINGTON,
Press Secretary.

SPECIAL ARTICLES

THE SHAPE OF THE CHICK EMBRYO GROWTH CURVE[1]

Murray[2] has found that the logarithm of the chick embryo weight when plotted against the logarithm of age yields a straight line from 5 to 19 days of age. Although he did not attach any significance to this observation, some of the later investigators, who apparently have confirmed Murray's finding, have on basis of it elaborated several different hypotheses regarding the nature of the growth process. Needham[3] in his exhaustive treatise on chemical embryology reviewed these adequately, and it is not necessary for the purpose of this note to reiterate any of them. It may be, however, mentioned that a recent generalization of the laws of growth (Glaser[4]) also utilizes Murray's observation.

It is obvious that, if chick embryo growth conforms to a single logarithmic straight line throughout the embryonic period, far-reaching consequences for generalized descriptions of the growth process may ensue. It is therefore exceedingly important to determine the validity of describing the total chick embryo growth by means of such a straight line.

In preparing a logarithmic plot of unpublished data from this laboratory, it was noted that while an excellent straight line fit was obtained for the portion of the growth curve from 7 to 12 days of age, a flexure was noted at about 12 days. The observed weights rose above the calculated ones, the difference between the two gradually disappearing towards the end of the embryonic life of the chick.

Fortunately, Needham (Appendix I, Table 3) lists a number of sets of embryo weights obtained by various investigators, thus affording an opportunity to examine these sets for similar deviations. The more complete sets comprising the data of Falck, Hasselbach (two sets), Bohr and Hasselbach, Lamson and Edmond, Iljin, Schmalhausen (two sets), Henderson and Brody, Romanoff, and Byerly (loc. of all cited by Needham) were thus utilized. Murray's data were obtained from his original paper, since Needham cites the calculated rather than the observed figures. In addition the data presented by Landauer[5] for normal embryos and the data from this laboratory[6] were used.

The procedure was to obtain the least squares fit to the straight line

$$\log w = \alpha \log t + b$$

for each of the sets for the period from 7 to 12 days of age. If the straight line fit is legitimate for the whole of the embryonic growth period, the equation obtained on basis of these six points should apply equally well to the period from 12 to 20 days. Calculated logarithms of weights for each age from 7 to 20 days were then obtained and the deviations from the observed logarithms of weights computed. In each case the origin of the deviations may be considered as the straight line resulting from a plot of calculated log weights against themselves. The slope of this line is equal to unity in all the sets. This permits calculation of the mean deviation with its standard error for each day of incubation.

It should be noted that the first four sets cited were recorded in 1900 and earlier. The conditions of incubation under which the embryos were grown were probably not optimum, since great advances in incubation technique have been made since that time. This fact would undoubtedly tend to distort the normal progress of growth, and because of it computations are presented both including and excluding these four sets. Thus for the first computation 14 sets of data were used, while for the second only 10. These numbers varied somewhat, since not all ages are represented in all the sets of data.

Table 1 presents the mean deviations for each age.

TABLE 1

Deviation of Observed from Calculated Logarithms of Embryo Weight

	All data (14 sets)		Data since 1900 (10 sets)	
Age	Mean deviation	Dev./S.E.	Mean deviation	Dev./S.E.
7 ..	.0009 ± .0057	.16	− .0006 ± .0055	.11
8 ..	.0036 ± .0088	.41	.0038 ± .0050	.76
9 ..	.0003 ± .0108	.03	.0046 ± .0115	.40
10 ..	.0076 ± .0096	.79	.0014 ± .0063	.22
11 ..	− .0049 ± .0132	.37	− .0053 ± .0121	.44
12 ..	− .0144 ± .0062	2.32	− .0066 ± .0044	1.50
13 ..	.0231 ± .0143	1.62	.0424 ± .0102	4.16
14 ..	.0376 ± .0133	2.83	.0527 ± .0112	4.71
15 ..	.0290 ± .0175	1.66	.0500 ± .0115	4.35
16 ..	.0278 ± .0201	1.38	.0468 ± .0173	2.71
17 ..	.0108 ± .0217	.50	.0405 ± .0157	2.58
18 ..	− .0075 ± .0268	.28	.0242 ± .0253	.96
19 ..	.0075 ± .0224	.33	.0169 ± .0225	.75
20 ..	.0061 ± .0270	.23	.0104 ± .0298	.35

The first series of computations indicate significant deviations only at 12 and at 14 days of age. It is, however, the second series that brings out the fact that the deviations observed originally in the data from this laboratory were not chance fluctuations. There appears to be a sharp acceleration in the observed growth at 13 days of age. The discrepancies between the observed and calculated logarithms of embryo weight rise to a maximum at 14 days and then grad-

[1] Assistance in computations was provided under WPA project A. P. No. 465-03-3-209.

[2] H. A. Murray, Jr., *Jour. Gen. Physiol.*, 9: 39, 1925.

[3] J. Needham, "Chemical Embryology," 3 vols. Cambridge University Press, 1931.

[4] O. Glaser, *Biol. Rev.*, 13: 20, 1938.

[5] W. Landauer, *Storrs Agr. Exp. Sta. Bull.*, 193, 1934.

[6] I. M. Lerner and C. A. Gunns. Unpublished, 1938.

ally decrease until they lose their statistical significance at 18 days of age. There remains but little doubt of the reality of these deviations, and the conclusion that a single straight line does not fit the whole period of embryonic growth seems unescapable.

It is of interest to note that a similar picture prevails in embryos incubated under the high temperature of 105° F. as revealed by similar computations involving the data of Henderson and Brody.[7] However, here the acceleration occurs at an earlier stage, which is, perhaps, in keeping with the usual temperature effects on rates of processes. The fragmentary data of the same workers on embryos incubated at 95° F. reveal a complete distortion of the logarithmic straight line. These observations lend support to the legitimacy of disregarding the data of the earlier workers.

The significance of the finding here reported undoubtedly needs further elaboration and explanation in biochemical terms. Thus the curve of log dry weight plotted against log time, presented graphically by Glaser from Murray's[8] data, shows a very pronounced flexure of the same type as observed here. The differentiation of energy sources during the course of embryonic growth (Needham, p. 992) may also be recalled in this connection, as may also fluctuations in glutathione concentration (Gregory, Asmundson and Goss[9]).

The purpose of this note, however, is limited to drawing attention to the fact that while individual sets of data may produce a satisfactory fit to the logarithmic straight line, small deviations in the same direction and appearing at the same time in the majority of sets of reliable data can not be disregarded. Cognizance of this situation is commended to workers in the field of embryonic growth.

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THE ROLE OF HEREDITY VERSUS ENVIRONMENT IN LIMB BUD TRANSPLANTS BETWEEN DIFFERENT BREEDS OF FOWL

USING the technique developed by Hamburger,[1] the author has transplanted 60- to 70-hour White Leghorn limb buds into the coelome of Brown Leghorn hosts of the same age. The host embryos were then allowed to develop until 15 or more days of age. Two different types of results have been obtained. In seven cases in which the grafts became attached to the mesenteries, a normal White Leghorn leg developed upon the Brown Leghorn host. The feathers of the transplant were white, and the scales on the shank and foot were characteristically pigmented. The White Leghorn graft, therefore, differentiated according to its hereditary potentialities. The environment, in these cases, seemed to have had no influence.

These results are at variance with those of Willier and his co-workers, who have reported[2] that White Leghorn limb buds developed colored plumage when grafted to colored breeds. Two grafts, however, have been obtained which seem to clarify this discrepancy. In one case the graft possessed Brown Leghorn feathers and the scales of the shank were pigmented, while the foot had yellow scales typical of the White Leghorn. In this instance environmental influences have been able to suppress, almost completely, the hereditary potentialities of the graft. In another the upper part of the leg was covered with brown feathers, the lower portion with white, and the shank and foot were unpigmented. This case, therefore, was an intergrade. Both these latter grafts were exceedingly well attached to the inner body wall.

These results indicate that White Leghorn plumage develops on grafts which are attached to the mesenteries and that Brown Leghorn plumage occurs on grafts that are attached to the body wall. It is possible that the results may be explained on the basis of a diffusion gradient between host and graft. If the graft is well attached to the host and an enzyme or "color-inducing substance" reaches the transplant in sufficient amounts, the hereditary potentialities of the graft are suppressed completely and the transplant develops the plumage and pigmentation characteristic of the host. If the attachment is less secure and a smaller amount of color-inducing substance reaches the graft, an intergrade results. In cases where little or no enzyme diffuses into the graft, a typical White Leghorn leg develops on the brown host. A further analysis of this problem is in progress.

In reciprocal transplants, Brown Leghorn limb buds transplanted to White Leghorn hosts, three different types of results were obtained. In several cases typical Brown Leghorn feathers developed upon the transplanted limb, and the shank and foot possessed the typical pigmentation of the Brown Leghorn. These results confirm the findings of Willier, who obtained similar results with skin grafts. In three cases the environment has suppressed, or at least retarded, the development of the brown feathers since 15-day-old transplants possessed all white feathers or else only a few feathers were pigmented.

[7] E. W. Henderson and S. Brody, *Mo. Agr. Exp. Sta. Res. Bull.*, 99, 1927.
[8] H. A. Murray, Jr., *Jour. Gen. Physiol.*, 9: 405, 1926.
[9] P. W. Gregory, V. S. Asmundson and H. Goss, *Jour. Exp. Zool.*, 73: 263, 1936.
[1] Viktor Hamburger, *Jour. Exp. Zool.*, 77: 379–399, 1938.

[2] B. H. Willier, Mary E. Rawles and E. Hadorn, *Proc. Nat. Acad. Sci.*, 23: 542–546, 1937.

In one fifteen-and-one-half-day transplant which was attached to the mesenteries of the host, the outer portion of the graft was covered with brown feathers, the inner portion possessed white plumage, and the characteristic brown pigment was lacking in the lower leg and foot. Furthermore, typical Brown Leghorn feathers covered the greater portion of the right wing of the host. Although this latter condition may have been due to a somatic variation, Dr. Harry L. Kempster, professor of poultry husbandry at the University of Missouri, joins me in the view that the pigmentation of the wing feathers has been induced by the graft. This case seems to indicate a mutual interaction between the host and transplant or between the hereditary constitution and the environment.

A diffusion gradient apparently does not explain these latter cases, since some well-attached grafts developed colored plumage and other less well-attached transplants possessed white feathers. Experiments are in progress which may shed additional light on the problem.

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NEW OBSERVATIONS ON THE EFFECTS OF CALCIUM DEPRIVATION[1]

THE authors have observed that a profound neurological disturbance develops in growing rats maintained on diets very low in calcium (0.01 to 0.02 per cent.) which has heretofore not been associated with a deficiency of calcium. The neurological picture, which is quite complex, is suggestive of a diffuse lesion involving the cortex, basal ganglia, spinal cord and peripheral nerves.

The nervous condition is best demonstrated by subjecting the experimental animals to short and mild galvanic shocks from an induction coil after they have been on the low calcium ration for six weeks or more. This stimulus causes the rats to collapse. The rats remain conscious, but they respond poorly and sluggishly to all stimuli. They show little ability to right themselves or to grasp objects with their paws. The fore limbs remain relatively normal, but there is always a paralytic foot drop of one or both hind limbs. Immediately after the onset of the collapse, the tail becomes anesthetic, while the head and trunk appear to be hyperesthetic. After a lapse of about 24 hours, the head and trunk also become anesthetic. The normal propulsive locomotion of these animals is greatly altered, and they generally show a retropulsive response which is not observed in the normal rat.

The effects of the disturbance appear to be reversible. The degree of prostration increases the longer the animals are kept on the calcium deficient diet. Severely depleted animals remain in a state of prostration for long periods of time and, as a result, usually die of inanition. Less severely deficient animals recover from the prostration after a varying period of time, even if they are still kept on the low calcium ration. Recovery, however, is hastened by feeding the control diet to the injured animals.

A condition similar to that which is induced by the galvanic stimulus may develop spontaneously in animals that have been maintained on the experimental diet for a period of from 9 to 14 weeks. The effect of the spontaneous collapse is very severe and the animals usually die within a few days.

Visible hemorrhage occurs frequently. In the central nervous system it has been observed in the cerebrum, spinal cord and the circle of Willis. This finding suggests that the neurological disturbance may well be a secondary effect of the vascular pathology. Hemorrhagic areas also have been noted in the lungs, gastro-intestinal tract, bladder, bone and in the muscles of the gluteal region.

Chemically, the calcium deficient animals exhibit a low blood calcium, which was found to vary from 4. to 6.6 mg per 100 ml of serum.

Tetany does not occur in animals when merely reared on the low calcium rations. Tetany can be induced in thyro-parathyroidectomized rats by placing them on the low calcium diet. It takes 4 to 6 weeks to develop on this regimen. The tetanic spasms can be induced with a galvanic shock or, even better, with the hissing sound from an air jet.

Another point of considerable interest is that although the bony skeleton is almost completely decalcified, the teeth appear to be relatively well calcified.

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BOOKS RECEIVED

ABEL, JOHN J. *Chemistry in Relation to Biology and Medicine with Especial Reference to Insulin and other Hormones.* (Willard Gibbs Lecture.) Pp. 79. Illustrated. Williams and Wilkins.

KARRER, PAUL. *Organic Chemistry.* Translated from the German by A. J. MEE. Pp. xx + 902. Nordemann. $11.00.

PROCTER, WILLIAM. *Biological Survey of the Mount Desert Region; Part VI, The Insect Fauna.* Pp. 49 Illustrated. Wistar Institute.

WILMARTH, M. GRACE. *Lexicon of Geologic Names of the United States (Including Alaska); Part 1, A-L.* Pp. 1244; *Part 2, M–Z.* Pp. 1245–2396. Geological Survey Bulletin 896, U. S. Department of the Interior. Superintendent of Documents, Washington. $2.50 per set.